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ARE THEORIES ABOUT SOCIAL CAPITAL EMPIRICALLY SUPPORTED? EVIDENCE FROM THE FARMING SECTOR

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Are theories about social capital empirically supported? Evidence from the farming sector

1 Introduction

In general, sustainable development has been defined as a process whereby future generations receive as much capital per capita as – or more than – the current generation has available (WCED 1987). Traditionally, this has included natural capital, physical or produced capital, and human capital (i.e., production factors). Together they constitute the wealth of nations and form the basis of economic development and growth. However, it has recently been recognised that these three types of capital only partially determine the process of economic growth because they overlook the way in which economic actors interact and organise themselves to generate growth and development. For the particular case of rural areas, a number of studies conducted over the last years have concluded that similar endowments with production factors do not necessarily lead to similar patterns of economic growth and development (see, for example, Trigilia 2001; Woodhouse 2006 or Nardone et al. 2010). The traditional approach to sustainable development therefore needs to be broadened so as to include 'social capital', which as indicated by Grootaert (1998) refers to the internal social and cultural coherence of society, the norms and values that govern interactions among people and the institutions in which they are embedded. Social capital is the bond that links societies together and without which there can be no economic growth or human wellbeing (Coleman 1988 and 1990; Putnam et al. 1993).[1]

There is therefore little disagreement about the relevance of social capital in regional and sustainable development. Nonetheless, much of the discussion about social capital is clouded both by the absence of a clear definition of the concept, and by the lack of reliable data to empirically test the theoretical framework. First, a primary limitation of the concept is the lack of agreement on its definition and meaning. Coleman (1988, p. 598), for instance, defines social capital as "*a variety of different entities, with two elements in common: they all consist of some aspect of social structure, and they facilitate certain actions of actors – whether personal or corporate actors – within the structure*". According to Putnam (1995, p. 19), "*... social capital refers to connections among individuals–social networks and the norms of reciprocity and trustworthiness that arise from them*", while Fukuyama (1995) defines social capital in terms of cultural values such as degrees of compassion, altruism, and

[1] It is important to remember that while a long list of benefits (such as facilitating coordinated actions, a reduction in the cost of transactions, and so on) is attached to the concept of social capital (Coleman 1988, 1990; Putnam et al. 1993; Onyx and Bullen 2000; Sobels et al. 2001), it is widely recognised in the literature that social capital also has a 'dark side' which could generate negative effects (Woolcock 1998; Fine 1999; Sobel 2002; Moseley and Phal 2007). This also applies to the farming sector.

tolerance. Although there is no exact meaning for the concept, these definitions have common elements that emerge as 'building blocks' for a formal definition which includes the formation of groups and other forms of civic activity or collective action. A second major obstacle in developing the concept of social capital, and empirically testing its validity, is the lack of reliable data. Thus, some of the most commonly referred proxies of social capital for which accurate data are available deal only with a specific type of social capital (i.e., formal associations). This partial approach is likely to affect the conclusions about the presence of social capital as its shortcomings are well known.[2] A more integral and multidimensional measure of the concept of social capital would certainly add to the existing literature.

The challenge in this paper is therefore twofold. First, we want to propose a suitable method for measuring social capital at the individual level, using structural equation models and taking into account the different dimensions of social capital (i.e., structural, relational and cognitive) and their attributes that have emerged as 'building blocks' of the concept within the social capital debate. Second, we present an empirical application of the method using a unique data set on farmers in Andalusia, southern Spain.

This paper adds to the literature in a number of ways. First, as already noted, the chronic lack of suitable data has so far been an impediment to both theoretical and empirical research of phenomena in which social capital may play a role (Durlauf and Fafchamps 2006). Our research aims to contribute further empirical evidence by grounding the measurement framework in a clear decomposition of the concept of social capital in its different dimensions and attributes. The availability of a representative micro cross-section data set with individuals' direct indicators of the core components of social capital clearly facilitates the empirical work.

Additionally, following Coleman (1988), a great part of the literature refers to social capital as all *"the aspects of the social structure that facilitate certain actions of actors within the structure ... making possible the achievement of certain ends that, in its absence, would not be possible"* (Coleman 1988, p. 98). Such 'productive' aspects of the social structure can vary according to different environmental situations and agents' needs, making it extremely difficult to provide a single, universal definition of what social capital is, or a unique, underlying method of measurement to be used within the empirical research. In this paper, we propose the simultaneous inclusion of the different dimensions of social capital through a set of attributes or sub-dimensions related to each of them, and which have been measured directly from the individuals in the survey. This multidimensional approach is then analysed by means of structural equation models, allowing for each specific group of individuals under study: (1) to confirm the multidimensional construct; (2) to measure the interrelation

[2] Sabatini (2009a) highlights that networks and their relational contents could be used in order to gain narrow and sectarian interests against the well-being of the wider community.

between each dimension and their attributes and; (3) to set a solid basis for additional research on the effects of social capital in the specific context of farmers in southern Spain. As a result, we will provide a methodology for a fuller, more comprehensive analysis of social capital that takes into account the multidimensional, dynamic and contextual characteristics of the concept.

The paper is structured as follows. The theoretical background of the concept of social capital and its implication in the rural sustainable development context are addressed in section 2. Particular attention is played to the role of social capital in the farming sector in section 3. The discussion continues with the description of the data set used (section 4) and of the methodological approach to the measurement of social capital (section 5). This methodology is then applied as a case study to farmers of Andalusia in southern Spain. Results are provided in section 6, while section 7 concludes.

2 Theoretical background: Understanding social capital as an asset for development and regional sustainability

Conventionally in economics, development and growth are based on the efficient adoption of the major production factors, i.e., natural resources, labour and capital. However, in recent years, empirical evidence has shown that the existence of social capital, understood as a set of norms and values shared by the population and a set of community networks (Woolcock and Narayan 2000), becomes crucial to ensure sustainable development as it allows a more efficient use of the available resources (i.e., natural resources, human capital and productive/physical capital). Thus, where people hold complementary norms, values, attitudes and beliefs (defined as forms of social capital) predisposing them to networking, cooperation and mutual assistance, a valuable set of assets can be created by joint action that is not only productive in the present but also into the future (Uphoff and Wijayaratna 2000). Research on social capital as the group of a community's non-economic resources that make cooperation among individuals and institutions possible in a positive and constructive way is appealing for social scientists as it allows a wide and multidisciplinary approach to provide responses to one of the most relevant questions for regional development, specifically that of regional sustainability.

Regarding the definition of social capital, a comprehensive review of previous works points to how several scholars have conceptualised it as a set of social resources embedded in relationships, highlighting the key role of networks of strong personal human relationships nurtured over time that provide the basis for trust, cooperation and collective action among individuals (e.g., Jacobs 1965; Loury 1977; Burt 1992). Further, other researchers have supported a broader definition of the concept that includes not only social relationships (i.e., social ties and trusting relations), but also the norms and values associated with them that facilitate actions between individuals located in the community even in the absence of specific relationships between them (e.g., Coleman 1990; Portes and Sensenbrenner 1993; Putnam 1995). Nahapiet and Ghoshal (1998) called these different aspects of the

social context the structural, the relational, and the cognitive dimensions of social capital. For the purposes of our research, we adopt their approach and also consider the different attributes of social capital to be represented within these three dimensions. Nonetheless, we agree that these three dimensions of social capital interact and are, in practice, connected and mutually reinforcing. It is important to emphasise that the distinction made here is intended to be analytical so that social capital can be understood and empirically measured in a more concise manner.

According to this view, the *structural* dimension of social capital describes the interpersonal formation of linkages between individuals or groups. The location of the individual's contacts in a social structure of interactions provides certain advantages for the actor. People can use their personal contacts to get jobs, obtain information, or access specific resources. Within the structural dimension, a key differentiation has been made in the literature between what has been called *bonding* and *bridging* social capital (Putnam 2000; Narayan 1999). Thus, bonding social capital refers to the social capital generated through the interaction between members of a relatively homogenous group, while bridging social capital refers to the social capital generated and shared through interconnections between heterogeneous groups.[3] Further, *linking* social capital describes ties connecting individuals, or the groups they belong to, or linkages with people or groups in a position of political or financial power. For example, civil society organisations allow citizens to come into contact with institutions to carry out advocacy activities through collective action. According to Evans (1996), such linkages allow groups to access resources, ideas, and information from institutions of power, thus enabling group members to 'scale up' micro-level social capital and social action to a politically and economically effective level. Among the most important features of this dimension are the presence or absence of network ties between individuals, and the configuration of their networks in terms of degree of proximity to the other members, as well as their functionality. In this paper, we use the structural dimension of the social capital concept to refer to the overall pattern of connections between individuals – that is, who you interact with and how.

In contrast, the *relational* dimension of social capital describes the type of personal relations people have built up between them through a number of interactions (Granovetter 1992), which are not necessarily long-lasting ones. The key attributes of this dimension will include *trust and trustworthiness* (Fukuyama 1995; Putnam 1993), *norms and social sanctions* (Coleman 1990; Putnam 1995), and *reciprocity* (Coleman 1990; Granovetter 1985; Nyhan Jones and Woolcock 2007).

Thus, while trust is an attribute of a relationship, trustworthiness is an attribute of an individual actor involved in the relationship (Barney and Hansen 1994). Trust can act as a control mechanism for

[3] As indicated by Woodhouse (2006, p. 85), it should be taken into account that the concepts of bonding and bridging social capital contain elements of both the relational and structural dimensions in that they indicate both a tendency for people to act in a certain manner (the norm of tending towards bonding or bridging links) and the capacity to do so (the fact of having friends or contacts either locally – bonding links, or externally – bridging links). This unobserved characteristic shall not be forgotten.

embedded relationships (Uzzi 1996) since it can encourage joint efforts (e.g., Gambetta 1988), and the lack of mutual trust is certain to impact negatively on development (Arrow 1974, p. 26). Likewise, a trustworthy actor (one who can be trusted by other actors) is likely to gain other actors' support for achieving goals to an extent that would not be possible in a situation where trust did not exist. For analytical purposes, and following Sabatini (2009a), different levels of trust have been identified in this research, namely *knowledge-based trust* as given by the confidence in well-known people, *generalised social trust* (i.e., trust towards unknown people), and *trust in public services* as a result of using and having access to such services. This latter attribute of trust in public services has specifically been considered in this research as a result of our focus on the importance of individual social capital for regional sustainable development. Pioneer insights from Kumlin and Rothstein (2005) show a positive and significant correlation between trust in public services and social trust and development. It will be interesting then to see how both attributes contribute to the accumulation of social capital at the individual level.

Equally, as argued by Coleman (1990), a norm exists when it represents a degree of consensus in the social system and becomes a powerful form of social capital as it may give individuals the confidence to invest in collective or group activities with the knowledge that others will do so as well as a result of interaction. *Norms and social sanctions* become, in effect, expectations that bind (Kramer and Goldman 1995), as does *general reciprocity,* which is understood as the combination of short-term altruism and long-term self-interest (Taylor 1982), or what de Tocqueville (1969) called 'self interest rightly understood'. The individual provides a service to others or acts for the benefit of others at a personal cost, but in the general expectation that this kindness will be returned at some undefined time in the future in case of need. In a community where reciprocity is strong, people care about each other's interests. As indicated by Nyhan Jones and Woolcock (2007), the usefulness of this element stems from the fact that in the vast majority of settings, cooperation for development is possible only if a significant amount of social capital of this kind is available in the community.

Finally, the third dimension of social capital, which is labelled as the *cognitive* dimension, refers to those resources that offer a joint code or a shared paradigm that facilitates a common understanding of collective goals and proper ways of acting in a social system (Ostrom 2000) in the absence of specific links and relations between individual members of the group. Such a common understanding is appropriable by the collectivity as a resource (Portes and Sensenbrenner 1993), capturing the essence of what Coleman (1990, p. 315) described as 'the public good aspect of social capital'. A key feature of this dimension is the level of *civicness* among individuals in the community. That is, people's propensity to keep themselves informed about public affairs. The claim for civicness is that well-informed citizens have a better knowledge of public affairs and a greater confidence in their ability to influence public choices. Therefore, they are more likely to be involved in collective action and public life (Putnam 2000). In essence, this cognitive dimension also refers to the compatibility of individuals' values with community values; its forms are ones that rationalise cooperative behaviour

and make it respectable. Thus, we further consider a second attribute of this dimension as the perceived degree of *community cohesiveness* since a certain degree of cohesiveness is always desirable for ensuring sustainable development. Coleman (1990, p. 303) showed how certain values collectively held among society's individuals can be a kind of social capital that benefits the society as a whole.

Having said all this, another reason to differentiate between the three dimensions of social capital, besides the existence or not of interaction between individuals and formal or informal ties, is explained in what follows. Structural forms of social capital make it easier for people to cooperate by lowering transaction costs and accumulating social learning. Thus, *structural* forms of social capital *facilitate* cooperation, while *cognitive* forms, as identified above, *predispose* people to cooperate; in part because once they are widely shared they make cooperation more likely (Uphoff 1999, p. 218). Lastly, norms, trust and reciprocity have often been written about as forms of cognitive social capital (in fact they arise from the mental realm), but besides the need of interaction between individuals one can see how values of truthfulness, attitudes of solidarity and beliefs in fairness similarly create and maintain an environment in which cooperation *becomes expected*. Thus, it is justified that this component of social capital is considered separately; it is the *relational* form of social capital.

A graphic representation of the conceptual framework explained above is illustrated in Fig. 1.

FIG. 1 AROUND HERE

Once again, although we separate these three dimensions analytically, we recognise that many of the features we describe are, in fact, very much interrelated. These three forms of social capital interact and in practice are connected and highly context dependent; only empirical analysis will shed some further light about their particular functioning.

Lastly, it is worth mentioning that social capital, as a concept rooted in the structure and content of relationships, can be operationally defined at different levels of analysis, including individuals (e.g., Belliveau et al. 1996), organisations (e.g., Burt 1992), or communities/societies (Putnam 1995). Given that we focus on relationships among farmers in this study, it is justified to measure the accumulation of the different components of social capital at the individual (farmer) level.

3 Social capital and the farming sector

Agriculture plays a vital role in the development of a large part of European rural territories due to its economic relevance as a sector that provides food and fibres to the population, but also due to its social (viability of rural communities) and environmental impacts. Therefore, studies on the development of rural areas must pay special attention to the performance of this sector, including a thorough knowledge of the different components of social capital between farmers. Traditionally, the important weight that specific associations have in the structuring of the agricultural sector has been the most widely studied component of social capital as it is by far the most distinctive feature and a very meaningful expression of social capital within the sector. Many associations (for example,

cooperatives or farmers unions) are based on trust between the farmers who intermediate in the promotion of development projects and in the implementation of agricultural policies.

When speaking about agricultural associations, it is important to eschew the cliché that this is a sector where individualism prevails; an idea which has no doubt contributed to the image of the independent farmer on scattered, isolated farms who decides his strategies with a high degree of autonomy and thinks only of the particular interests that affect him and his family (the notion of "amoral familism" coined by Banfield in 1958 has been widely discussed by sociologists and anthropologists to refer to the *peasantry*). However, as pointed out by Moyano (2008), if we look closely at the reality of modern agriculture, we find a different picture which reveals a high rate of social and economic structuring with a high density of associations. Indeed, farmers often form part of one or several associations of a different nature and for different reasons: (1) to defend their general interests (as occurs with professional organisations, also called *farmers unions*); (2) to articulate their specific interests as producers tied to a particular type of agricultural or livestock production (such as *sectoral organisations*); (3) to purchase inputs or commercialise their products (as is the case of *cooperatives*); (4) to manage water resources in a particular area (through irrigation water users' associations); (5) to mediate in the regulation of markets (such as *organisations of producers*); (6) to jointly undertake phytosanitary treatments or for animal health (through plant and animal health defence associations, respectively); or (7) to ensure the quality of production in certain sectors (through the '*appellation d'origine*').

Thus, the farmer has a considerable amount of associational resources to learn new techniques and acquire know-how, obtain informal training from others who have already adopted such practices, and even obtain help in implementing various agricultural techniques. Further, the role of networks in conveying information about employment and market opportunities has been greatly emphasised (Fafchamps and Minten 1998; Granovetter 1995; Montgomery 1991; Rauch and Casella 2001). In the literature on knowledge spillover, social ties and contacts play a crucial role not only in the dissemination of ideas but also in the cross breeding of ideas through social interaction (Krugman 1991). When individuals share common interests and beliefs, which is often the case in associational activities, communication among them is more likely to be effective. As a result, learning from groups may be more effective than other avenues of learning. These facts suggest that social capital in the farming sector positively impacts on the economic and productive performance of the farmers and is a key component for *economic sustainability*.

To the types of associations mentioned above, we should also add the entire network of associations of a non-agricultural nature in rural areas. These associations also play an important role in the social structure of the territories, further contributing to the defence of cultural and natural heritage, social cohesion, the promotion of entrepreneurial initiatives and to the construction of a social identity (cultural, civic, religious, developmental, women's and youth associations, environmental groups, etc.). The importance of associations in development policies (e.g., rural

development policies) has been highlighted by several authors from the perspective of "social capital" since associations emerge as a result of trust between individuals and are the basis for greater trust and new collective efforts to undertake projects that benefit the whole community (Putnam 1993). In addition, the role of associations as intermediate actors in the implementation of public policies is highly valued. Social capital is, therefore, linked to the quality of the existing associative environment at the local level, and has a significant influence on the dynamics of development in rural areas and ultimately on the viability of rural communities and their social cohesion (i.e., *social sustainability*).

Furthermore, social capital among farmers, as built through community involvement, may also enhance social responsibility by promoting the use of sustainable agricultural farming practices and thereby contributing to *environmental sustainable development*. This issue of social responsibility is a major theme in the literature on agricultural technology adoption. Lynne and Casey (1998) and the more theoretically based work of Chouinard et al. (2008) found that farmer motivation is multifaceted – farmers are motivated by self-interest, as well as values and beliefs. A decision to adopt a new agricultural practice can be influenced by attitudes toward the efficiency (and profit potential) of the practice, as well as the public-interest values and beliefs related to social norms.

The above evidence suggests the importance of social capital among farmers for the sustainability of rural territories and once more justifies the theoretical and practical utility of the proposed analysis.

4 Data: Survey area, questionnaire design and data collection

The empirical research was carried out within the Autonomous Region of Andalusia (southern Spain). Andalusia has an extension of 87.5 million km^2 and a population of 7.6 million inhabitants accounting for 17.8% of the Spanish population. Administratively, the region is divided into 8 provinces (Almeria, Cadiz, Cordoba, Granada, Huelva, Jaen, Malaga and Seville) comprising a wide variety of agricultural systems from intensive greenhouse crop production in littoral areas to traditional inland Mediterranean systems of olive groves, cereals and vineyards, and more extensive marginal ones in mountain areas which are mainly devoted to animal production. A third of Andalusia's residents live in rural areas with a proportion of the population engaged in agriculture that it is three times higher than the EU27 average (9% of agricultural employment). This is an economic sector which has decreased in importance as a job provider, but which still remains the main source of income in half of the municipalities of Andalusia (Consejería de Agricultura y Pesca 2010). Given the strong agricultural tradition of this region, and the increasing importance given to the agriculture sector as a provider of private and public goods and services to society so as to ensure sustainable rural development, it seems very appropriate to use Andalusia as the case study for the purpose of this research.

The data set we use is derived from the 2012 Survey entitled "*Farmers and Social Capital*" (IESA-CSIC 2012). This is a survey conducted by the Institute of Advanced Social Studies of the National Research Council (IESA-CSIC) in Spain with a representative sample of 998 farmers. The sample was drawn with a stratified, multistage design using probability sampling. To reduce sample dispersion and facilitate the fieldwork, municipalities of the different counties were randomly selected first, followed by the random selection of farmers. The maximum expected absolute error term (p=q=0.5) is ±3.5% with a confidence level of 95%. A summary statistical description of the surveyed farmers is shown in Table 1.

TABLE 1 AROUND HERE

The rationale behind this research is that the accumulation of social capital among farmers will likely have an impact on rural development (see Section 3). We want to know more about the social capital accumulated by farmers; a concept of a multidimensional nature that has already been widely discussed in the literature. Nonetheless, it is evident that social capital as a resource is elusive, and cannot be seen or touched. Hence it can only be measured by making reference to those features of society with which its development is associated, i.e., the process which results in the accumulation of social capital. As discussed in the theoretical background section, there is general agreement that this process includes aspects of society such as associations, trust, norms and sanctions, civicness, generalised reciprocity, or community cohesiveness. We argue that in order to capture the intangible concept of social capital, a functional measurement method should focus on direct indicators of each of these features. This arrangement is one way of overcoming the conceptual plainness of this kind of immaterial resources and allows us to focus the research on the specific dimensions and attributes of social capital, which are more relevant in the context of regional and agricultural policies for sustainable development.

For this purpose, we have relied on previous empirical works dealing with the measurement of social capital (e.g., Grootaert et al. 2002; Sabatini 2009a). In this sense our contribution is twofold. First, based on the comprehensive theoretical framework already presented in Section 2, we have collected the more well-grounded proxies of the different attributes of social capital for its measurement at the farmer level. Second, we have adapted these proxies or indicators to our particular case study and have validated the resulting questionnaire by a pilot survey which tested that the respondents correctly understood the questions and the accuracy of the measurement of the indicators related to these features. The variables related to social capital asked in the survey are described in Table A1 in Appendix A[4]. Questions related to the farmers' demographic, socioeconomic and productive characteristics have also been included in the questionnaire.

[4] Not all the variables enumerated in Table A1 were finally used in the analysis. Before estimating the structural equation models, scale validation tests were performed to ensure that the variables met the required psychometric properties. Those variables that fail to do so were removed from the analysis (further details provided in Section 6).

Finally, it is worth mentioning that in order to maintain the sample size, imputation techniques were used to estimate values for missing values. In particular, multivariate imputation by chained equations and k-nearest neighbour algorithms were applied to maintain the 998 observations. Further details on the imputation procedure are reported in Appendix B.

5 Methodological approach: Structural equation models

The motivation behind this research is the need to achieve a greater understanding of the multidimensional and dynamic concept of social capital through a rigorous analysis that significantly contributes to theoretical and empirical progress in the field. To do so, the relationships between the different dimensions of social capital and their attributes are assessed through Structural Equation Modelling (SEM) with robustness checks carried out by means of some model refinements.

SEM is a statistical technique developed from other multivariate techniques such as multiple regression and path analysis (Hair et al. 1998). The two main features of SEM are the estimation of multiple cross-dependency relationships and the ability to capture unobserved concepts in such relationships while controlling for measurement error. The resulting model is an attempt to capture reality in a simple way by incorporating measurements of both observed and latent variables and taking into account the interaction between the dimensions or 'constructs' considered. For a detailed explanation about the foundations and application of this statistical technique the manuals of Kaplan (2000), McDonald and Ho (2002) and Kline (2010) are recommended. This technique is used here to confirm the theoretical framework developed above as these models are proposed by considering a set of initial hypotheses that exactly match the variance and covariance structure of the variables under consideration, while neither confirming nor contradicting causality.

SEM proceeds in two stages. The first stage is the estimation of the *measurement model*, which represents a set of observable variables as multiple indicators of a smaller set of latent variables (dimensions and sub-dimensions or attributes of social capital), and the *theoretical model*, which describes dependency relations between the latent variables, and which is grounded in theory (hypotheses). The second stage is the *estimation of the structural model*, which is a combination of the measurement and path models.

The purpose of the hypotheses tested in this study is to shed further light on the relationship between the different dimensions and sub-dimensions of social capital. Therefore, based on some of the results reported in the literature on social capital, as well as on the theoretical model proposed, we will set up a number of hypotheses to test the relationship between the different dimensions and some of their attributes identified in the conceptual framework. However, it is important to highlight and reflect on the fact that despite the interconnection and overlapping between dimensions, the nature of the linkage connecting these dimensions and their attributes is also highly context-dependent and the

context may be changeable depending on whom we are investigating, how, and when. Hence, the results provided here should not be generalised to other circumstances.

As mentioned earlier on, the purpose of this paper is to provide a comprehensive framework for measuring and empirically testing the formation of social capital through structural equation models. The nature of the interrelations needs to be carefully assessed in every specific case study. In this sense, we begin by testing the relationship between the *structural and relational* dimensions of social capital. In general, the structural dimension of social capital, observable as social interaction ties, may stimulate trust, perceived trustworthiness and reciprocity, which represent some of the attributes of the relational dimension of social capital. Previous studies have suggested that trusting relationships evolve from social interactions (Granovetter 1985). As two actors interact over time, their trusting relationship will become more concrete, and the actors are more likely to perceive each other as trustworthy. As suggested by Woodhouse (2006), extensive association among community members, either informally or through voluntary groups and societies, will encourage local people to utilise local goods providers and local services rather than seeking them beyond the community. Thus, where there are strong social networks based on reciprocity and trust, a productive pattern of formal and informal social organisation emerges (Uphoff and Wijayaratna 2000), making other forms of capital more effective by increasing the productivity of individuals and groups (Coleman 1988; Putnam 2000).

Nevertheless, this is only one side of the picture. Experience suggests that these interactions may play a double-sided role in sustainable development and individuals' well-being. While it is true that they are a fertile ground for nurturing trust and shared values, which reduce monitoring costs and facilitate transactions, networks can, however, work in the opposite direction as members of a group may use their ties as a means to pursue narrow sectarian interests, and organisations may lobby against the interests of other groups. At the aggregate level, this mechanism may positively or negatively influence the process of development, providing an explanation for growth differentials among regions with similar endowments in terms of other forms of capital (Putnam et al. 1993; Guiso et al. 2004).

Thus, the conventional distinction between *bonding*, *bridging*, and *linking* reflects the different roles that networks may play in shaping the development of a society by nurturing trust. The term *bonding* holds a negative connotation in terms of development (Putnam 2000; Narayan 1999), while the common claim is that *bridging* and *linking* have positive effects on the diffusion of information and trust, thus fostering transactions and economic growth (Sabatini 2009b). Notwithstanding, economic studies suggest that much of their impact depends on the context, which is why it is important to take them all into account. This hypothesis, therefore, splits into three sub-hypotheses as follows:

> *H1a. Bonding social capital is negatively associated with the perceived level of trust, trustworthiness and reciprocity.*

H1b. Bridging social capital is positively associated with the perceived level of trust, trustworthiness and reciprocity.

H1c. Linking social capital is positively associated with the perceived level of trust, trustworthiness and reciprocity.

A second step will be to link the different attributes of the *cognitive and relational* dimensions. Overall, the existence of a deep and, equally important, common understanding of collective goals (cognitive dimension of social capital) may also encourage the development of trusting relationships (Ostrom 1998; 2000). Thus, specific results have shown how 'ideal' *cohesive communities* with common values and a shared vision will nurture *trust and reciprocity* among individuals (Williams 1998), promoting participation and co-operation for development. Similarly, an assumption present in much of the literature on social capital is that broad *social trust* is necessarily correlated to the presence of *civicness*, that is, an ethical inclination towards the pursuit of the public good (Putnam 1993). In particular, Ljunge (2012) argues that *civicness* captures facets of *trustworthiness*, Coleman (1988) states that its presence is also likely to positively impact the follow-up of a basic democratic value such as an established set of *norms and social sanctions* (i.e., tolerance), while Kumlin and Rothstein (2005) hypothesise that, in well-developed societies, it is reasonable to suspect that people's views of the society around them and of their fellow human beings are shaped to a great extent through their contacts with *public institutions* and their perceived level of trust. Interestingly, their analysis further shows a positive and significant correlation between *social trust* and *trust in public services*, suggesting that extensive and efficient public services may reinforce trust in other people and the development of society overall. In sum, this second hypothesis also splits into a number of sub-hypotheses as follows:

H2a. Community cohesiveness is positively associated with the perceived level of trust, trustworthiness and reciprocity.

H2b. Civicness is positively associated with the perceived level of trust.

H2c. Civicness is positively associated with the perceived level of tolerance.

H2d. Civicness is positively associated with the perceived level of trust on public services.

H2e. The perceived level of trust is associated with the level of perceived trust in public services.

Lastly, the motivation to examine the relationship between the *cognitive and structural* dimensions relies on the premise that social interaction (*bonding*, *bridging* and *linking* social capital) plays a critical role both in shaping and sharing common goals and values among the members of a community, thus fostering the diffusion of *civicness* and cooperative values (Putnam et al. 1993; Brehm and Rahn 1997). The set of sub-hypotheses here would be as follows:

H3a. Bonding social capital is positively associated with the level of civicness.

H3b. Bridging social capital is positively associated with the level of civicness.

H3c. Linking social capital is positively associated with the level of civicness.

6 Results

6.1 Measurement analysis

Before estimating the structural equation models, the scales used to measure the different components of social capital must be validated to ensure that they meet the required psychometric properties[5] of reliability, dimensionality, convergence and discriminatory power (Anderson and Gerbing 1988). The scale validation process comprised two consecutive and related stages. In stage 1, the scales used in the model were tested individually, while stage 2 consisted of a confirmatory factor analysis to test their joint validity.

In this study, model estimation and scale validation were conducted using R software. Table 2 shows the psychometric property scores of the three dimensions or constructs (structural, relational and cognitive) and the ten sub-dimensions or attributes considered (i.e., bonding, bridging, linking, knowledge-based trust, trust in public services, generalised social trust, reciprocity, norms and social sanctions, community cohesiveness, and civicness). The first step, therefore, is to check the scales to determine whether any of the items (indicators or observable variables) need to be removed[6]. Having done this, the scale is then subjected to a *reliability analysis* to assess the internal consistency of the items using Cronbach's (1951) alpha coefficient which must be higher than 0.7 (see column "α" in Table 2). Further reliability tests were performed: average variance extracted (see column "AV" in Table 2), which should be greater than 0.5 (Hair et al. 1998) and composite reliability[7] (see column "CR" in Table 2), which should take a value greater than 0.6 (Bagozzi and Yi 1988). Overall, the scales passed the composite reliability tests, showing relatively good results. Since we are using categorical variables, the reported values are expected to be smaller than if using numeric ones, which explains the lower values in some of the cut-offs (Cronbach, 1951). However, the model captures the

[5] Psychometric properties are the requirements that a measuring scale must meet in order to fulfil its purpose in a rigorous and scientifically valid manner. Satisfying these properties is essential if a measuring scale is to be efficient in collecting data related to the measurable construct, while also representing reality as accurately and reliably as possible (Nunnally 1978).

[6] Desirable item characteristics are high correlation (to increase the internal consistency of the scale), high variance (making it easier to differentiate between respondents with different levels of the trait being measured), and a mean close to the middle of the range (to minimise outliers). The full list of variables used in the analysis is reported in Appendix A.

[7] According to Hair et al. (1998), composite reliability (CR) is a measure of the internal consistency of the indicators of a construct showing the degree to which they indicate the common latent construct. Average variance extracted (AV) is another reliability measure showing the amount of total variance in the indicators that is captured by the latent construct.

underlying pattern of correlation between the variables well, further justifying the results provided (see also Fig. 2).

TABLE 2 AROUND HERE

Equally, in order to verify whether each of the attributes in each dimension of social capital has its own clearly defined identity, they were subjected to a *dimensionality test*. Despite the 'ordinal' nature of the variables in our analysis, the KMO measure (Kaiser-Meyer-Olkin test) was estimated using the Pearson correlations for 'numeric' variables. As indicated in the literature (Batista-Foguet and Coenders-Gallart 2000), using ordinal variables as numeric ones in structural equation models is correct if we have latent variables measured with more than two indicators. Overall, the results were close to the range between 0.6 and 0.7, allowing us to accept the entire exploratory factor analysis (Kaiser 1974).

The next step is the *convergent validity test*, which is conducted by means of a confirmatory factor analysis to ensure that each scale represents the concept it is intended to measure. This is done by simply checking that the indicators are correlated. A significant number of variables were removed from the model because they were distorting the proposed factor structure, thus diminishing the Cronbach's alpha coefficient and having low and non-significant factor loadings. Finally, the goodness-of-fit measures, that is, the statistical significance of the chi-square (χ^2) coefficient and the CFI, GFI, AGFI and RMSEA values[8], produced an acceptable fit of the covariance-matrix data as can be seen in Table 2.

Further, the *discriminant validation* results (Table 3) show to what extent the different attributes designed to measure similar but conceptually different constructs overlap. A scale is valid in this sense when it measures only the concept it is supposed to measure and no other characteristic of any other concept. Using the approach in which discriminant validation is confirmed if the Cronbach's alpha of each scale is higher than any of the correlations between that scale and the rest, we observe that some sub-dimensions overlap within the structural and relational dimensions of social capital (i.e., bonding and bridging social capital for structural; and thick trust, social trust and reciprocity for relational), thus suggesting the existence of a superior construct/dimension that includes these sub-domains. This does not apply to the sub-dimensions or attributes related to the cognitive dimension of social capital. In fact, the correlation plot in Fig. 2 provides a clear picture of the gatherings between the different constructs.

TABLE 3 AROUND HERE

FIG. 2 AROUND HERE

[8] Meaning of statistic considered. χ^2: chi-square; CFI: comparative fit index; GFI: goodness-of-fit index; AGFI: adjusted goodness-of-fit index; RMSEA: root mean square error of approximation. The CFI, GFI and AGFI indices should be close to 0.9 or 1.0 and the error measure should not exceed 0.1 and ideally lie between 0.05 and 0.08 as noted by Hair et al. (1998).

Table 4 reports the discriminant validation results of the second order for the trust, trustworthiness and reciprocity attributes into a larger construct which we call *trust and reciprocity*. It is confirmed that the Cronbach's alpha of this new construct is higher than any of the correlations between that construct and the remaining ones. The results were not so successful for the bonding and bridging social capital attributes (structural dimension) which fail to merge into a higher dimension (i.e., bonding and bridging social capital proved to not be a significant component of a higher construct). Thus, in this particular case study, we may separate these two attributes, being aware of the strong correlation that exists between them. Lastly, as proposed by Anderson and Gerbing (1988), the confidence intervals of the correlations between the pairs of dimensions were also estimated and checked for values of 1, not finding any.

TABLE 4 AROUND HERE

Finally, following the scale validity assessment, *confirmatory factor analysis* (CFA) was then applied to the 29 measurement variables combined into a single factor/construct. The robust maximum likelihood method was selected as the estimation algorithm. A comparison of the results with those obtained for the CFA of the eight-construct model used to develop and test the eight-dimension (bonding, bridging, linking, trust and reciprocity, perceived trust in public services, norms and social sanctions, community cohesiveness and level of civicness) measurement model corroborated that the survey instrument resulted in a summated scale that reliably and validly measured the eight separate dimensions. In contrast to the single-factor model, the eight-factor model achieved a better goodness of fit. The goodness-of-fit values for the single-factor model were χ^2: 4895.623 ($p<0.000$); CFI: 0.406; GFI: 0.673; AGFI: 0.622; RMSEA: 0.110; RMSEA (Bootstrap)=0.115 (n_bootstrap=1000).

6.2 Structural Equation Models of the structural, cognitive and relational dimensions of social capital

Having completed the scale depuration process, the next stage in the analysis is to test the hypotheses outlined earlier against the results of the estimated model. Fig. 3 provides a graphic representation of the eight-construct model resulting from the previous stage. This representation follows the path analysis symbology. Such connections are represented both graphically by arrows, and numerically by regression coefficient estimates and p-values in brackets. The causal nexus between two variables is represented by a straight arrow moving from the independent variable to the dependent one. Table 5 further reports goodness-of-fit measures for the estimated model.

TABLE 5 AROUND HERE

FIG. 3 AROUND HERE

First of all, the goodness-of-fit indices are within the pre-established optimal range. The results confirm that, despite our attempt to gather the different attributes of social capital in three different

global dimensions (i.e., structural, relational and cognitive), this is a far more complex concept that must be studied as being composed of a number of attributes that characterise it (the larger the list, the more comprehensive the approach). After more than two decades of active research in social capital, these attributes or features of the concept arise as 'building blocks' that first need to be considered independently as they may be interrelated differently from one another and gathering would hide the results. Nonetheless, the three-dimension approximation has proven to be quite an intuitive and comprehensive approximation to the social capital concept that may be followed if taking into account the potential interrelation between the different attributes.

More specifically, and narrowing down to the hypothesis considered in this research, the results confirm how *bridging* has a significant positive effect on the diffusion of trust and reciprocity (*H1b*) while *bonding* has a negative (weaker significance) connotation in terms of building trust (*H1a*), and no significant results are reported for *linking* (*H1c*). Further, attributes related to the cognitive dimensions of social capital (i.e., *civicness* and *community cohesiveness*) seem to be positively associated with the level of perceived trust and trustworthiness (*H2a, H2b*), norms and social sanctions (*H2c*) and the level of perceived trust in public services (*H2d*), all of which are attributes related to the relational dimension. Simultaneously, the results also indicate a significant and strong relationship between the *level of trust and reciprocity* and the level of trust in public services (*H2e*). Thus, it is expected that as the relational dimension of social capital is nurtured, it will encourage local people to utilise trusting local resources (private or public) affecting the development of the region. Finally, social interactions, in particular *bonding* (*H3a*) and *linking* (*H3c*), play a significant role in increasing civicness among individuals. Weak significance has only been found in this relation for *bridging* (*H3b*).

In sum, the confirmation (and non-confirmation) of most of the proposed relationships between social capital attributes demonstrates the need to consider the multidimensional nature of the concept of social capital when using it as a "production factor" in sustainable development processes. As social capital researchers, we are mere observers of individuals' behaviour and the approach proposed in this research offers a good opportunity to get a wider picture.

7 Discussion and conclusions

As already discussed in the Introduction, the mobilisation of social capital at the local level to enhance sustainable development in rural areas of Europe has become increasingly visible and vital. In this context, the agricultural sector becomes a key and dynamic actor and farmers must use their productive resources (i.e., physical and human capital as well as social capital) to influence long-term sustainability by adapting and innovating to accommodate the changing demands of the economy. Therefore, it is important to have an understanding of the factors directly or indirectly influencing the creation of social capital among farmers. To do so, the approach followed in this paper constitutes a

step forward for a more rigorous and systematic assessment of the construction of social capital at the individual level. Overall, this paper contributes to the social capital literature by providing an analytically reliable concept of social capital and a methodological tool for empirically measuring and testing a theoretical model of how social capital is built as a production factor at the individual level, which has not been sufficiently investigated to date. Thus, a comprehensive definition of social capital is proposed which includes a whole range of attributes proposed in the social capital literature. These attributes are further classified within one of the following three dimensions: structural, relational and cognitive, which have been considered in an attempt to ensure the full representation of the different characteristics ('building blocks') identified in the definitions of the concept provided so far. In this regard, it is important to emphasise a few ideas: 1) the interconnection of the different dimensions of social capital; and 2) the fact that the list of attributes is not meant to be an exhaustive and therefore closed one. The nature of the linkage connecting these dimensions and their attributes is highly context-dependent and therefore the results provided here should not be generalised to other circumstances (regions, economic sectors or periods of time). Nonetheless, we believe, the methodology proposed in this research (both the indicators collected and the structural equation model estimated) arises as a fundamental starting point to inform social capital policymakers and help them implement the necessary tools to facilitate sustainable development processes.

For the particular case study of Andalusian farmers, the overall results indicate that, as expected, both attributes related to the *structural* and *cognitive* dimensions of social capital seem to be positively associated with the level of perceived trust and trustworthiness (attributes related to the *relational* dimension), while interaction ties (*structural*) are positively related with some degree of civicness (*cognitive*). However, contrary to our expectations, there does not seem to be just three dimensions that include all the different aspects of the social capital concept. Therefore, it would be a mistake to draw conclusions by simply including the different indicators of social capital in one of these dimensions without undergoing further testing so as to confirm its validity. The approach proposed in this paper allows us to do so.

The next challenge left for future research should be to simultaneously utilise these various forms of social capital to investigate their impact on sustainable development outcomes either at the individual level or county/regional level. This would allow us to test the significance of the relations between the different attributes of social capital and a whole set of indicators regarding individual farms or regions' performance (i.e., economic sustainability in terms of income or wealth creation, social sustainability in terms of employment and population fixation, and environmental sustainability in terms of levels of erosion, pollution and other negative externalities related with farming activities). This would facilitate the design and implementation of more efficient agricultural and rural development policies aimed at achieving sustainable development in rural areas.

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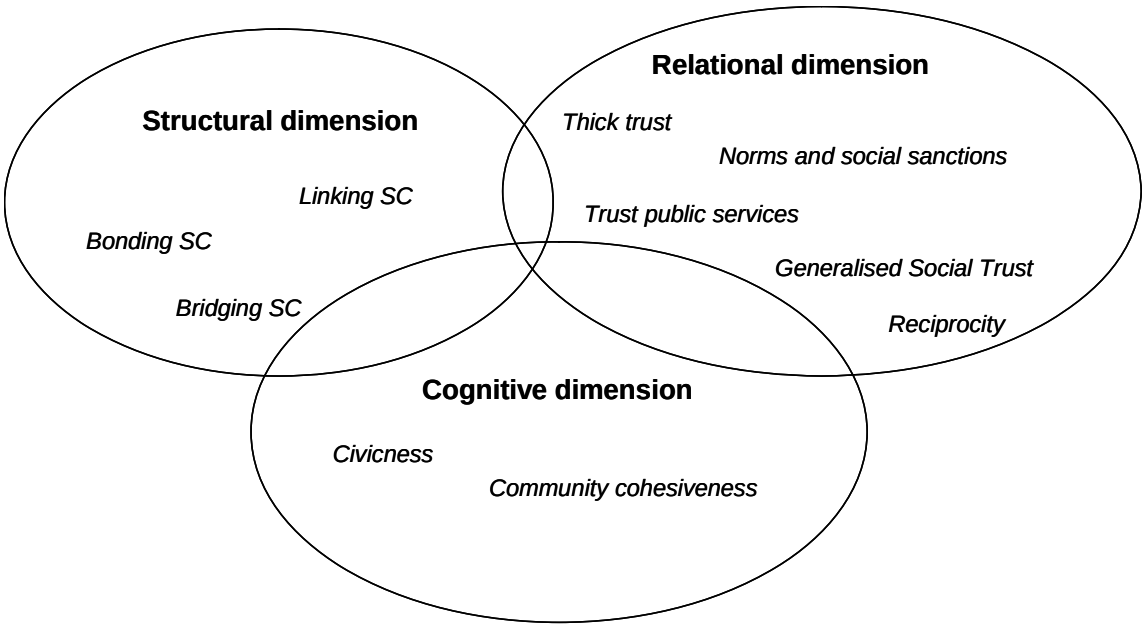


Fig. 1 Conceptual framework of social capital

Table 1 Descriptive statistics

Variables	Category	%
Gender	Male	69.6
	Female	30.4
Age	<40	11.8
	41-65	55.3
	>65	32.9
Education	No studies	41.8
	Primary education	33.8
	Secondary education	14.8
	Tertiary education	9.31
Have you received any specific training in agriculture?	Yes	40.5
	No	59.5
% of time you employ in agricultural activities	0%	15.0
	<=25%	35.9
	26%-50%	12.4
	51%-75%	1.7
	>75%	31.5
Is there anyone to continue the business once you retire?	Yes, for sure	24.3
	Quite likely	22.3
	Maybe yes, maybe no	10.9
	Very unlikely	16.3
	Not for sure	11.4
	Don't know	14.6
% of income that comes from agricultural activity	0%	14.3
	<=25%	43.2
	26%-50%	8.4
	51%-75%	2.3
	>75%	21.2
Farm size (%)	Only livestock	0.4
	< 1 ha	19.7
	2-5 ha	36.3
	6-20 ha	24.6
	21-50 ha	8.9
	>50 ha	5.0
	Non response	5.0
Farm ownership	Owned	85.2
	Rented	3.4
	Owned + Rented	5.9
Type of land	Irrigated	20.6
	Non-irrigated	54.6
	Irrigated + non-irrigated	19.3

Table 2 Reliability and confirmatory factor analysis for the different components of social capital

	Variable	Mean	SD	λ	α	AV	CR	KMO
ESTRUCTURAL	BONDING				0.693	0.531	0.693	0.58
	Bond1	4.461	0.703	0.701				
	Bond3	4.511	0.557	0.755				
	BRIDGING				0.631	0.464	0.634	0.59
	Bridg1	4.107	0.757	0.648				
	Bridg3	4.175	0.543	0.713				
	LINKING				0.718	0.413	0.678	0.760
	Linking1	2.467	1.377	0.606				
	Linking2	1.455	0.999	0.683				
	Linking3	1.463	0.889	0.636				
	χ^2=26.293 (*p*=0.000); CFI=0.988; GFI=0.992; AGFI=0.981; RMSEA=0.037; RMSEA (Bootstrap)=0.047 (n_bootstrap=1000)							
RELATIONAL	THICK TRUST				0.699	0.608	0.745	0.58
	Thicktrust2	4.411	0.625	0.570				
	Thicktrust3	3.906	0.821	0.944				
	PUBLIC				0.748	0.432	0.751	0.761
	Trstpubl1	3.975	0.854	0.577				
	Trstpubl2	4.068	0.766	0.751				
	Trstpubl3	3.863	0.768	0.662				
	Trstpubl4	3.826	0.825	0.628				
	GEN. SOCIAL TRUST				0.578	0.426	0.592	0.54
	Gst1	3.486	0.863	0.547				
	Gst2	3.670	0.734	0.743				
	RECIPROCITY				0.613	0.346	0.613	0.644
	Reciprocity1	3.685	0.803	0.572				
	Reciprocity2	3.676	0.915	0.621				
	Reciprocity3	2.884	0.965	0.570				
	TOLERANCE				0.591	0.423	0.594	0.52
	Tolerance1	3.895	0.879	0.606				
	Tolerance2	4.036	0.776	0.692				
	χ^2=185.118 (p=0.000); CFI=0.956; GFI=0.971; AGFI=0.956; RMSEA=0.046; RMSEA (Bootstrap)=0.057 (n_bootstrap=1000)							
COGNITIVE	COHESIVE				0.650	0.319	0.651	0.688
	Cohesive1	3.660	1.098	0.560				
	Cohesive2	3.768	1.028	0.628				
	Cohesive3	4.449	0.675	0.561				
	Cohesive4	4.305	0.784	0.504				
	CIVICNESS				0.858	0.552	0.859	0.826
	Civicness1	3.631	0.986	0.624				
	Civicness2	3.363	1.024	0.811				
	Civicness3	3.567	0.954	0.819				
	Civicness4	2.998	1.127	0.732				
	Civicness5	2.935	0.962	0.711				
	χ^2=180.091 (p=0.000); CFI=0.944; GFI=0.961; AGFI=0.933; RMSEA=0.077; RMSEA (Bootstrap)= 0.084(n_bootstrap=1000)							

Note: During the measurement analysis, a number of variables were removed because they were distorting the proposed factor structure. That is, the factor loadings were small or not significant and their omission significantly increased the Cronbach's alpha coefficient. The full list of observable variables used in the analysis is reported in Appendix A (Table A1).

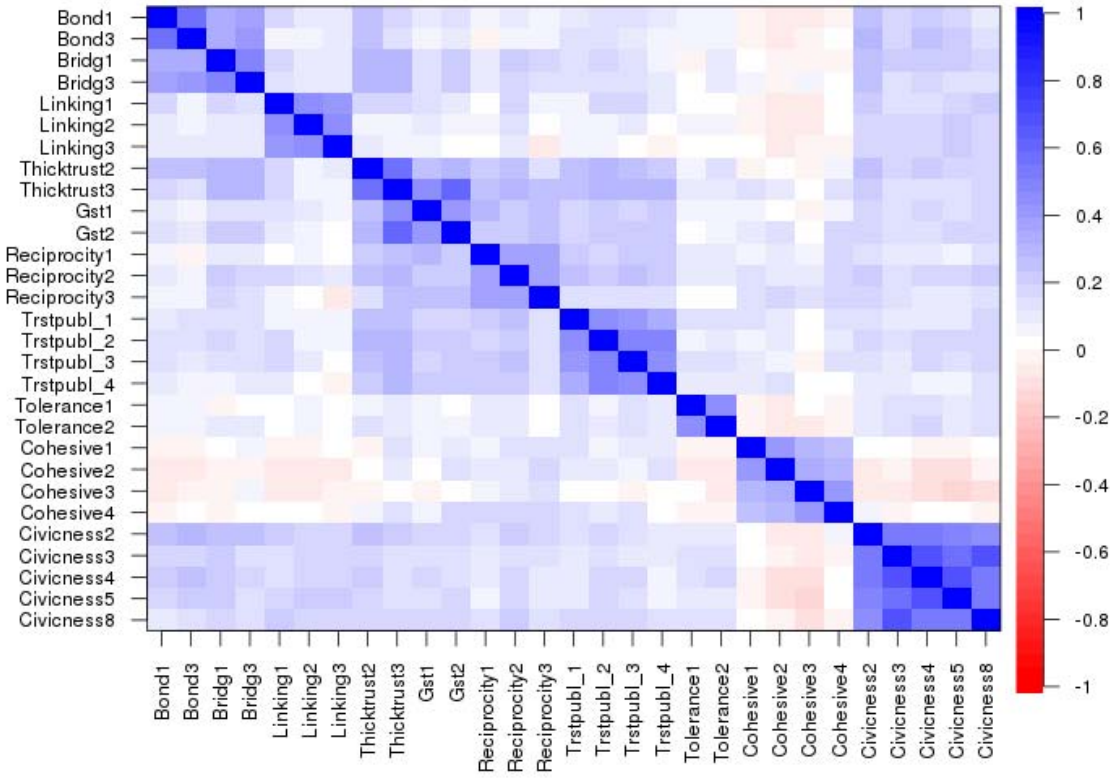


Fig. 2 Correlation plot

Table 3 Discriminant validity for the first-order factor analysis measures[a]

	Bonding	Bridging	Linking	Thick Trust	GST	Reciprocity	Public Trust	Tolerance	Cohesiveness	Civicness
Bonding	**0.69**									
Bridging	0.82	**0.63**								
Linking	0.15	0.17	**0.72**							
Thick Trust	0.25	0.50	0.13	**0.70**						
GST	0.27	0.53	0.15	0.92	**0.58**					
Reciprocity	0.18	0.39	0.13	0.61	0.70	**0.61**				
Public Trust	0.21	0.33	0.17	0.51	0.58	0.48	**0.75**			
Tolerance	0.12	0.13	0.07	0.16	0.16	0.16	0.19	**0.59**		
Cohesiveness	-0.16	-0.02	-0.09	0.18	0.24	0.27	0.14	-0.08	**0.65**	
Civicness	0.40	0.37	0.37	0.24	0.30	0.26	0.27	0.28	-0.13	**0.86**

[a] The Cronbach's alpha appears in bold on the main diagonal for each scale and should be higher than the correlation between that scale and the remaining scales.

Table 4 Discriminant validity for the second-order factor analysis measures[a,b]

	Bonding	Bridging	Linking	Trust + reciprocity	Public Trust	Tolerance	Cohesiveness	Civicness
Bonding	**0.69**							
Bridging	0.82 (0.010) [0.798,0.839]	**0.63**						
Linking	0.15 (0.031) [0,084,0.206]	0.17 (0.031) [0.113,0.233]	**0.72**					
Trust + reciprocity	0.29 (0.029) [0.228,0.342]	0.56 (0.022) [0.516,0.602]	0.16(0.031) [0.101,0.222]	**0.90**				
Public Trust	0.21 (0.030) [0.146,0.265]	0.33 (0.028) [0.278,0.388]	0.17(0.031) [0.110,0.231]	0.60(0.020) [0.565,0.643]	**0.75**			
Tolerance	0.12 (0.031) [0.054,0.177]	0.11(0.031) [0.052,0174]	0.07(0.031) [0.013,0.136]	0.13(0.031) [0.070,0.192]	0.17(0.031) [0.106,0.227]	**0.59**		
Cohesiveness	-0.16 (0.031) [-0.225,-0.104]	-0.02(0.032) [-0.086,0.038]	-0.09(0.031) [-0.148,-0.025]	0.25(0.030) [0.188,0.305]	0.14(0.031) [0.084,0.205]	-0.09(0.031) [-0.143,-0.029]	**0.65**	
Civicness	0.40 (0.027) [0.348,0.452]	0.37(0.027) [0.320,0.427]	0.37(0.027) [0.322,0.428]	0.31(0.029) [0.256,0.368]	0.27(0.029) [0.210,0.326]	0.29(0.029) [0.230,0.344]	-0.13(0.031) [-0.188,-0.066]	**0.86**

[a] The Cronbach's alpha appears in bold on the main diagonal for each scale and should be higher than the correlation between that scale and the remaining scales.

[b] Interscale correlation. The figures in parentheses refer to the measurement error, while those in square brackets indicate the confidence interval.

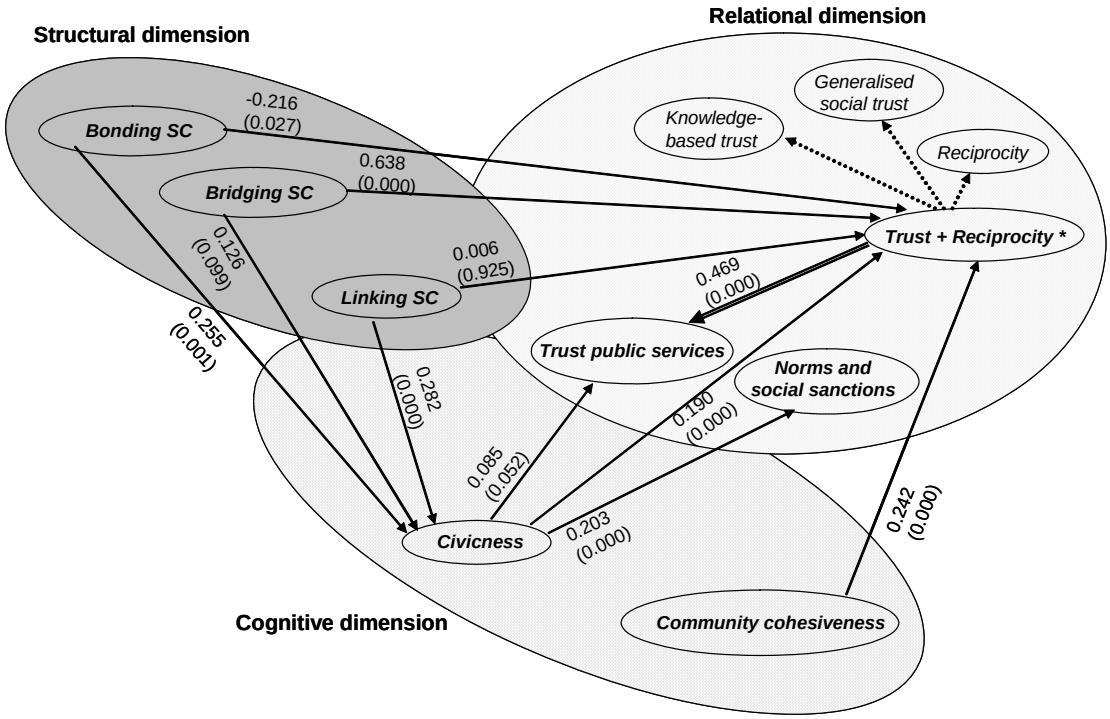


Fig. 3 Estimates of the structural model on the relationship between the different dimensions and sub-dimensions of social capital

* Lambda values reported for the second-order construct 'trust and reciprocity' with 0.860 for *Knowledge-based trust*, 0.946 for *Generalised social trust*, and 0.585 for *Reciprocity*.

Table 5 Goodness-of-fit statistics for the estimated model

Variables	Model
Global fit indices	
χ^2	1080.380
p-value	0.000
Goodness-of-fit index (GFI)	0.930
Robustness of mean squared error approximation (RMSEA)	0.045
Scaled noncentrality parameter (SNCP)	0.723
Expected cross-validation index (ECVI)	1.178
Comparative fit indices	
Comparative fit index (CFI)	0.905
Tucker-Lewis index (TLI)	0.893
Adjusted goodness-of-fit index (AGFI)	0.915
Normed Fit Index (NFI)	0.865
Parsimony fit indices	
Parsimony goodness-of-fit index (PGFI)	0.822
Normed χ^2	3.009
Parsimony normed fit index (PNFI)	0.765
Akaike information criterion (AIC)	75330.079

APPENDIX A. Variables used in the measurement of social capital among farmers

Table A1 List of variables used in the measurement of social capital among farmers

Variable Label	Description	Possible responses	1st order construct	2nd order construct
Bond1	In the last 12 months, how often have you met with your close family?	1 to 5 where 5 is the highest level	Bonding	STRUCTURAL
Bond2	How often do you talk to your close family about agricultural issues?	1 to 5 where 5 is the highest level		
Bond3	How satisfied are you with the relationship you have with your close family?	1 to 5 where 5 is the highest level		
Bridg1	In the last 12 months, how often have you met with your friends and neighbours?	1 to 5 where 5 is the highest level	Bridging	
Bridg2	How often do you talk to your friends and neighbours about agricultural issues?	1 to 5 where 5 is the highest level		
Bridg3	How satisfied are you with the relationship you have with your friends and neighbours?	1 to 5 where 5 is the highest level		
Linking1	In the last year, how often have you taken active part in gatherings of an agricultural/livestock cooperative?	1 to 5 where 5 is the highest level	Linking	
Linking2	In the last year, how often have you taken active part in gatherings of a professional agricultural organisation?	1 to 5 where 5 is the highest level		
Linking3	How many of the professional associations cited above do you belong to?	1 to 4		
Thicktrust1	Which level of trustworthiness do you assign to your family members?	1 to 5 where 5 is the highest level	Knowledge-based trust	RELATIONAL
Thicktrust2	Which level of trustworthiness do you assign to your friends?	1 to 5 where 5 is the highest level		
Thicktrust3	Which level of trustworthiness do you assign to the people in your village?	1 to 5 where 5 is the highest level		
Trstpubl1	Could you tell me your level of trust with the police?	1 to 5 where 5 is the highest level	Trust public services	
Trstpubl2	Could you tell me your level of trust with the public health care system?	1 to 5 where 5 is the highest level		
Trstpubl3	Could you tell me your level of trust with public transport?	1 to 5 where 5 is the highest level		
Trstpubl4	Could you tell me your level of trust with the educational system?	1 to 5 where 5 is the highest level		
Trstpubl5	Could you tell me your level of trust with the court system?	1 to 5 where 5 is the highest level		
Trstpubl6	Could you tell me your level of trust with telecommunications?	1 to 5 where 5 is the highest level		
Trstpubl7	Could you tell me your level of trust with the media?	1 to 5 where 5 is the highest level		
Gst1	Generally speaking, which level of trust do you have with people?	1 to 5 where 5 is the highest level	Generalised social trust	
Gst2	Which level of trust do you think exists among the neighbours of your village?	1 to 5 where 5 is the highest level		
Gst3	In the last year, do you think the level of trust among the neighbours of your village has decreased (1); remained equal (2); or increased (3)?	1 to 3		
Reciprocity1	How much do you agree with the following statement: "If I help someone, that person will help me when I need it"?	1 to 5 where 5 is the highest level	Generalised reciprocity	
Reciprocity2	How much do you agree with the following statement: "Farmers help each other in case of need or emergency"?	1 to 5 where 5 is the highest level		
Reciprocity3	How much do you agree with the following statement: "People in the village look after others' needs and interests"?	1 to 5 where 5 is the highest level		

Table A1 List of variables used in the measurement of social capital among farmers (cont.)

Variable Label	Description	Possible responses	1st order construct	2nd order construct
Tolerance1	How much do you agree with the following statement: "If a farmer from the village does not follow the 'conditionality' principle, is it fair that he receive less subsidies"?	1 to 5 where 5 is the highest level	Norms and social sanctions	COGNITIVE
Tolerance2	How much do you agree with the following statement: "If a co-op member does not follow the co-op's rules, he/she should be expelled from the co-op"?	1 to 5 where 5 is the highest level		
Cohesive1	Are there significant differences in your village regarding 'land ownership'?	1 to 5 where 5 is the lowest level of differences	Community cohesiveness	
Cohesive2	Are there significant differences in your village regarding 'political party disputes'?	1 to 5 where 5 is the lowest level of differences		
Cohesive3	Are there significant differences in your village due to 'religious' reasons?	1 to 5 where 5 is the lowest level of differences		
Cohesive4	Are there significant differences in your village because of 'ethnic' problems?	1 to 5 where 5 is the lowest level of differences		
Cohesive5	How much 'regional identity' do you think exists among the people living in the region?	1 to 5 where 5 is the highest level		
Cohesive6	How much of your spare time do you devote to activities geared towards the development of your region?	1 to 5 where 5 is the highest level		
Civicness1	How interested are you in issues related to 'agriculture and the rural world'?	1 to 5 where 5 is the highest level	Civicness	
Civicness2	How interested are you in the development of your region?	1 to 5 where 5 is the highest level		
Civicness3	How interested are you in issues related to 'regional district' (i.e., county)?	1 to 5 where 5 is the highest level		
Civicness4	How interested are you in issues related to 'Spain'?	1 to 5 where 5 is the highest level		
Civicness5	How interested are you in issues related to the 'European Union'?	1 to 5 where 5 is the highest level		
Civicness6	How informed do your think you are about issues related to 'agriculture and the rural world'?	1 to 5 where 5 is the highest level		
Civicness7	How informed do your think you are about the degree of development of your region?	1 to 5 where 5 is the highest level		
Civicness8	How informed do your think you are about issues related to your 'regional district'?	1 to 5 where 5 is the highest level		
Civicness9	How informed do your think you are about issues related to 'Spain'?	1 to 5 where 5 is the highest level		
Civicness10	How informed do your think you are about issues related to the 'European Union'?	1 to 5 where 5 is the highest level		
Civicness11	Did you vote in the last municipal elections?	(1) Yes; (0) No		
Civicness12	How much do you think you can personally affect decisions taken in your municipality?	1 to 5 where 5 is the highest level		
Civicness13	How much do you agree with the following statement: "If there was no surveillance, farmers in your region would not follow the norms necessary to receive any type of subsidies"	1 to 5 where 5 is the highest level of agreement		
Civicness14	How much do you agree with the following statement: "Farmers in your region decrease the amount of fertilisers to avoid water contamination"?	1 to 5 where 5 is the highest level of agreement		

APPENDIX B. Missing data imputation

We first identified the variables with the greatest number of missing values. These are *Trstpubl4*, *Trstpubl5* and *Trstpubl6* with around 10% of missing values in each one. In a second step, we examined whether the missing values in each of the variables in the model tended to appear next to the missing values of other variables. We found that precisely the variables *Trstpubl4*, *Trstpubl5* and *Trstpubl6* are those that tend to submit missing values jointly.

To see if the pattern of missing values was related to the values of other variables, we analysed the correlation between the variables with missing values and all the questionnaire variables, focusing on the variables included in the model and especially on the variables with the greatest number of missing values.

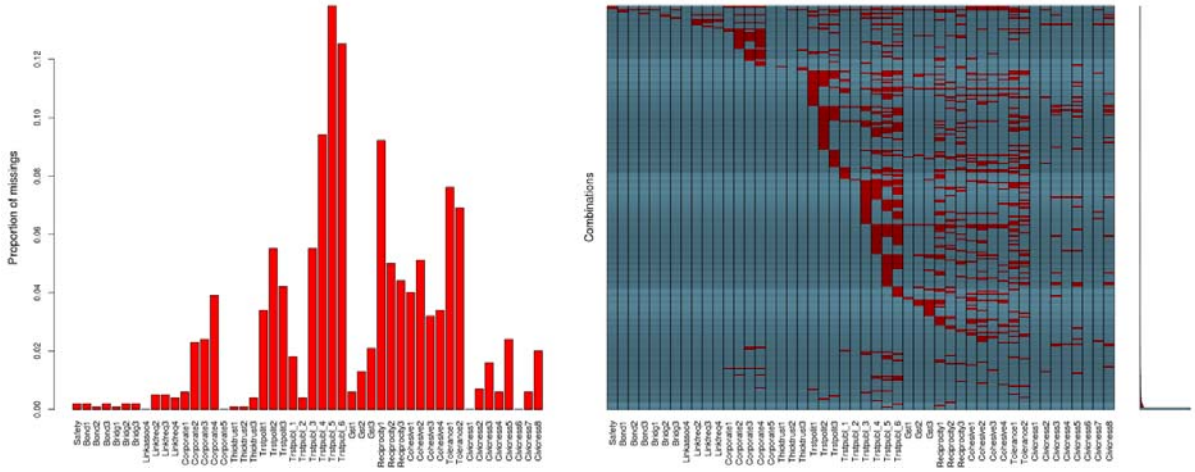
In light of the results of the analysis, it can be assumed that the missing data behave as missing at random and are therefore likely to be imputed without loss of representativeness.

Two imputation techniques were used:

1. Multiple imputation using the algorithm "*multivariate imputation by chained equations*" implemented in the R package mice (van Buuren and Groothuis-Oudshoorn 2011). Basically, this algorithm predicts the missing values of a variable by using a predictive model that takes into account the values in other variables. These predictions are used to predict the missing values of other variables, including those that acted as predictive variables. The process is repeated until the missing values in all the variables are stabilised or the degree of change is negligible.
2. *k-nearest neighbour imputation*. This is a non-parametric method that defines the distance between individuals in a p-dimensional space where p is the number of variables considered. Thus, an individual that has a lost value in variable X will be assigned the most frequent value of X between the k individuals that are most similar to him in the rest of the variables.

In the process of multiple imputation, 5 sets of imputed data were obtained. We calculated the structural equation model for each of the 5 sets of data by comparing it with the adjusted model to the data without imputed values. No significant differences were found. Results are available from the authors upon request.

Another set of imputed data was obtained by the method of k-neighbours. In this case we chose to consider 5 neighbours. It was noted that, for this data set, the matrix of correlations and the parameters of the model were very similar to those obtained both in the non-imputed data set and the data set obtained using multiple imputation. Therefore, we chose to use the set of data obtained by the k-neighbours method, even though we could have chosen any of the previously obtained data sets.



71

72 **Fig. B1** Missing pattern for single variables (left) and missing pattern for combinations of these
73 variables (right)